USM Mechanical Engineering

EME 432 Internal Combustion Engines	Spring 2011	Prof. Horizon Gitano
Homework #2	Rev. 1	www.skyshorz.com/university/resource.php

HW#2   **Internal Combustion Engines**

1) A special "oxygenated fuel" is being promoted to reduce CO emissions from ICEs. Its formula is $C_5H_{10}(OH)_2$. Keep in mind that the fuel contains some oxygen, and use ($O2 + 3.76 N2$) for air.

A) What is the molecular weight of the fuel [gm/mole]?

B) What is the Air/Fuel mass ratio for Stoichiometric combustion?

2) In accordance with Malaysia's drive to convert vehicles to Natural Gas (ie. NG Vehicles) you have converted your motorbike to run on Methane (CH_4). To demo your new NGV you plan to drive it 250km (total distance) from the Natural Gas filling station in Perai to Taiping, up Bukit Larut and back. Use the following data for your vehicle:

Engine:	4-Stroke		Displacement:	125 cc	
Equivalence Ratio:	1.05	(Slightly Rich)	Fuel:	CH_4	
Operating speed:	2500 rpm	(Average)	Vehicle Speed:	65 km/h	(Average)
Throttle:	50%	(ie. the pressure in the combustion chamber is ½ bar at IVC)			

Also remember that the engine is intaking **Air** and **Fuel** on each intake stroke (not just **Air**).

A) What is the Air/Fuel Ratio (mass)?

B) What % of the intake gas is fuel (in terms of % volume)?

C) How much CH_4 will be consumed [kilos]?

D) The max. pressure of the fuel tank is 200 bar, how big will the tank have to be [liters]?

E) What are the vehicles emissions of CO_2 in [gm/km]?

3) A car may have the following exhaust gas emission numbers (DRY):

NOx: 275ppm   CO: 1.0%   CO$_2$: 13% O$_2$: 2.5% HC:150 ppm   (by volume)

What is the approximate mass air fuel ratio if the fuel is assumed to be C_6H_{14}?

4) A typical automotive SI engine will have about 400cc displacement per cylinder, and a CR of 10. Assume B=S, the pressure in the cylinder is 0.90 bar at BDC, and isentropic compression.

A) What is the dead volume per cylinder [cc]?

B) What is the pressure at TDC?

C) What is the temperature at TDC [°C]?